

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

POC0335 – ORGANIC CHEMISTRY

(Foundation in Life Sciences students only)

13 March 2020
3.00 p.m – 5.00 p.m

(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 5 pages with 5 questions only.
2. Answer ALL questions.
3. Please write all your answers in the answer booklet provided.
4. Distribution of marks for each question is given.

Instructions: Answer **ALL** questions.

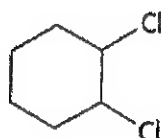
Question 1 [10 marks]

- a. Draw an expanded structural formula for the following saturated hydrocarbon: [1 mark]

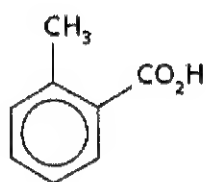


- b. What are the molecular formulae of the following compounds? [2 × ½ mark]

(i)

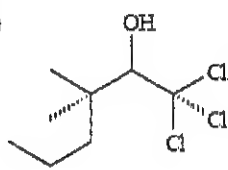


(ii)

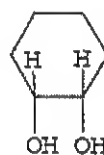


- c. Give the IUPAC names for the following compounds: [4 × 1 mark]

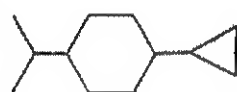
(i)



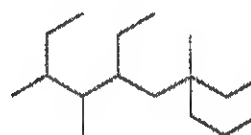
(ii)



(iii)



(iv)



- d. Draw the geometric isomers of 1,2- and 1,3-dimethylcyclobutane. [2 marks]

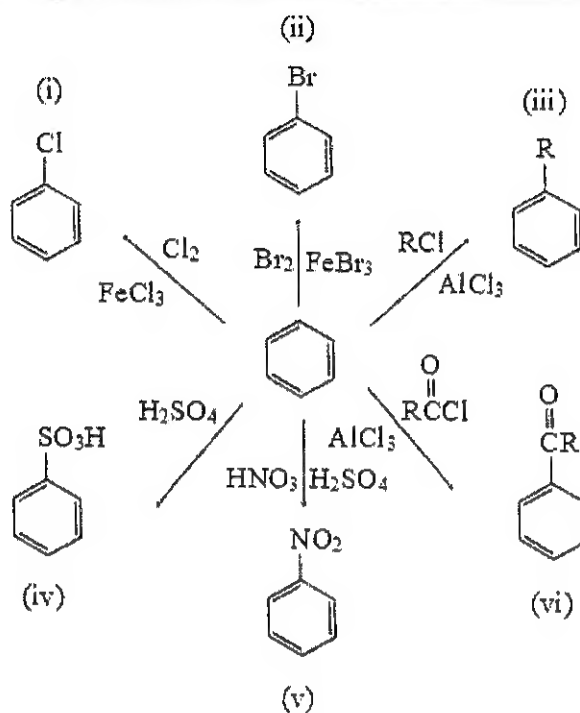
- e. There are four structural isomers of $\text{C}_4\text{H}_9\text{OH}$. Draw them and specify which one of them can exist as a pair of optical isomers (that is, which one is chiral). [2 marks]

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Question 2 [10 marks]

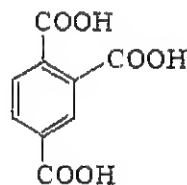
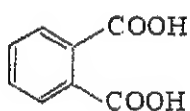
a. Name the following electrophilic aromatic substitution reactions.

[6 × ½ mark]

b. Three hydrocarbons A, B and C with the formula C_9H_{12} were oxidised by hot potassium manganate(VII).

- Hydrocarbon A gave benzoic acid, $\text{C}_6\text{H}_5\text{COOH}$
- Hydrocarbon B gave benzene-1,2-dioic acid.

- Hydrocarbon C gave benzene-1,2,4-trioic acid:



Suggest the structures of A, B and C.

[3 × 1 mark]

c. Write equations illustrating the following reactions:

- (i) benzene and 2-chloropropane with aluminum trichloride catalyst. [1 mark]
- (ii) *p*-dibromobenzene with concentrated nitric and sulfuric acids. [1 mark]

d. Devise a synthesis for *p*-ethylbenzenesulfonic acid from benzene (via 2 steps).

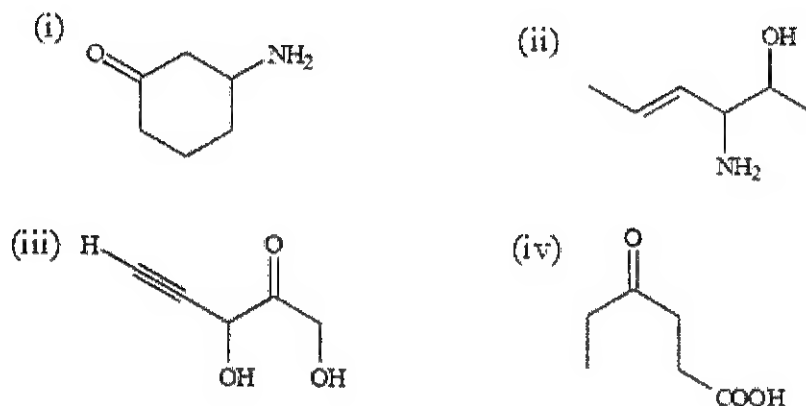
[2 marks]

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Question 3 [10 marks]

a. Give the IUPAC names for the following compounds:

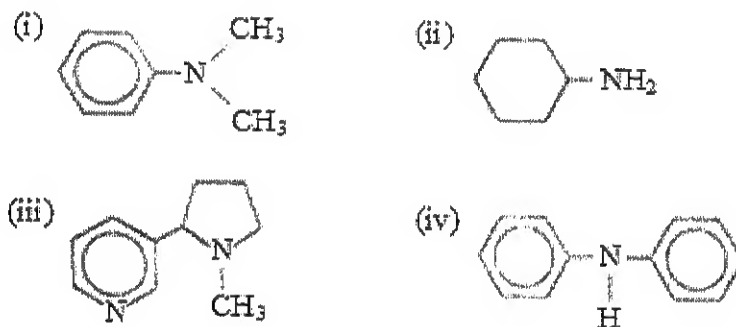
[4 × 1 mark]



b. Compound **A** has the molecular formula C_4H_8O (an aldehyde). It reacts with Fehling's solution. On treatment with sodium tetrahydridoborate(III), it gives **B** (a primary alcohol), which on warming with concentrated sulfuric acid gives 2-methylpropene. Identify **A** and **B** (draw and name the structures). [2 × 1 mark]

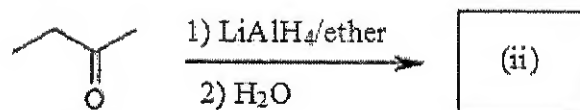
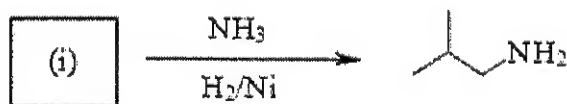
c. Classify the following amine compounds as primary, secondary or tertiary.

[4 × ½ mark]



d. Complete the following reactions:

[2 × 1 mark]



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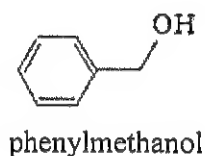
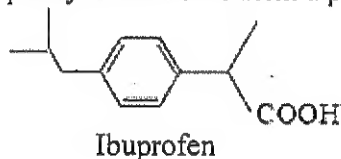
Question 4 [10 marks]

a. Draw the general formula for FOUR carboxylic acid derivatives as below:

[4 × ½ mark]

- (i) Acid halide (ii) Acid anhydride (iii) Amide (iv) Ester

b. An unwelcome side effect of the non-steroidal anti-inflammatory drug (NSAID) ibuprofen is irritation of the gastro-intestinal tract. This can be reduced by reacting it with phenylmethanol to form a prodrug.

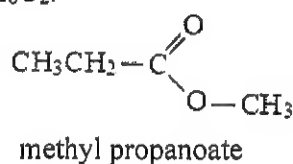
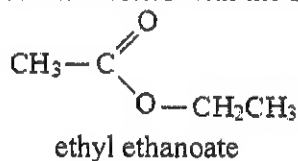


The resulting compound has the added advantage of being more easily transported through the intestinal cell walls into the bloodstream.

- (i) What type of compound will the prodrug be? [½ mark]
(ii) Suggest reagents and conditions for making the prodrug. [½ mark]
(iii) Draw the structure of the resulting compound. [1 mark]

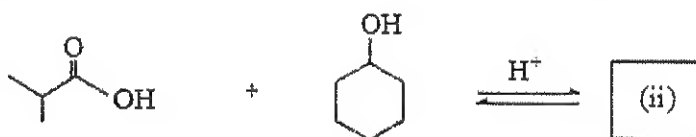
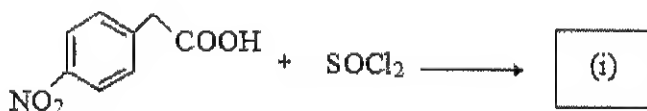
c. Two isomers of $C_4H_8O_2$ are shown below. Draw the structures of the other two isomeric esters with the formula $C_4H_8O_2$.

[2 × 1 mark]



d. Complete these reactions:

[2 × 1 mark]



e. Draw the structures for the following compounds.

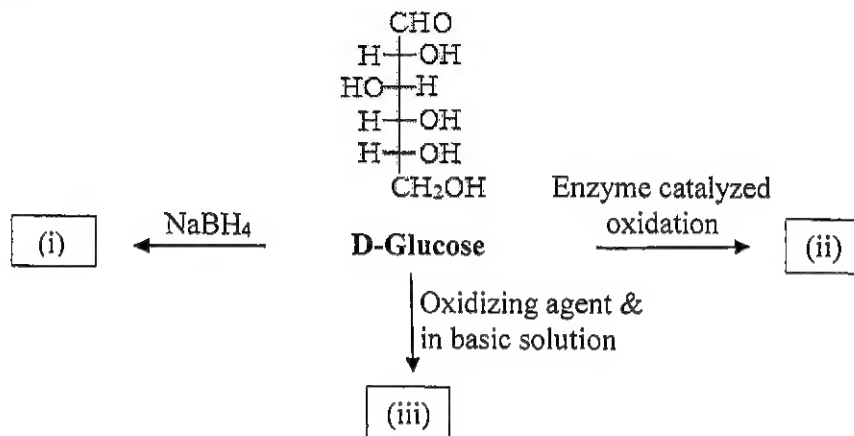
[2 × 1 mark]

- (i) 2-Chloro-3-phenylbutanoic acid
(ii) 2-Oxocyclopentanecarboxylic acid

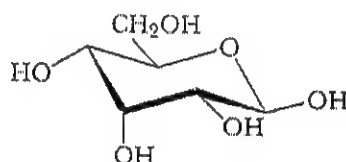
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Question 5 [10 marks]

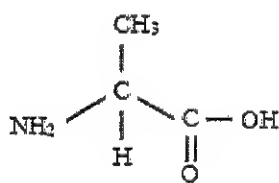
- a. Complete the following reactions by drawing the structures and name the compounds formed. [3 × 1 mark]



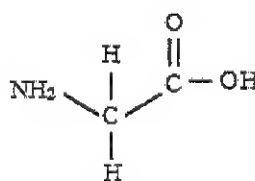
- b. Below is the chair conformation of D-Allose. Convert it to an open-chain form and then to a Fischer projection. [2 × 1 mark]



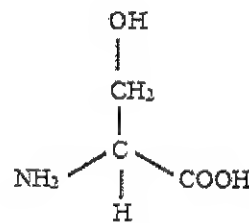
- c. Amino acids are the building blocks of naturally-occurring polymers called proteins. Consider the three amino acids below,



Alanine (pI = 6.11)



Glycine (pI = 6.06)



Serine (pI = 5.68)

- (i) State the abbreviation for alanine and glycine. [2 × ½ mark]
 (ii) Draw the zwitterion structure for serine. [1 mark]
 (iii) Deduce the structure of the tripeptide formed and indicate the peptide bond in the structure. [2 marks]
 (vi) Describe the behavior of glycine during paper electrophoresis at pH 6.06. [1 mark]

End of Paper